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(71) Applicants
Valor Newhome Limited,
Riverside House,
Corney Road,
Chiswick,
London W4 2SL.
(72) Inventors
Josef Rosiek,
Frank Spruce.
(74) Agents
Messrs. W.P. Thompson & Co.,
Coopers Building,
Church Street,
Liverpool L1 3AB.

(54) Solid fuel effect gas fires

(57) A coal and/or log effect gas fire comprises a gas burner formed by at least one member (2) having a plurality of bores (3) formed therein, which bores (3), in use, feed a gas/air mix. A plurality of coal and/or log elements (4) are located above the member (2) adjacent to the outlets of the bores (3). Realism can be enhanced by burning neat gas passing through passages in the coal and/or log elements (4).

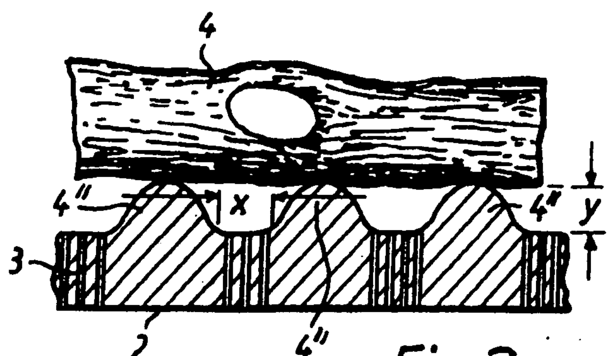

Fig 2

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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

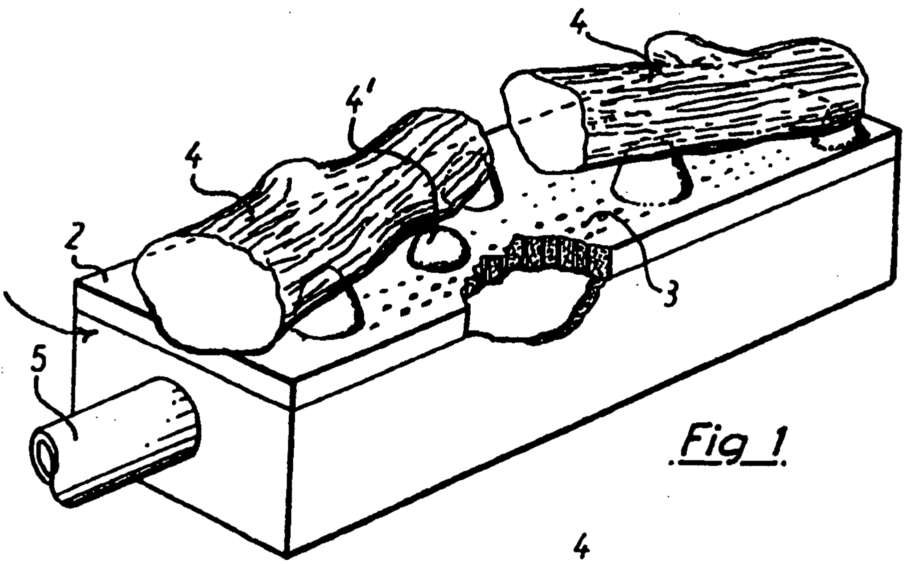

Fig 1.

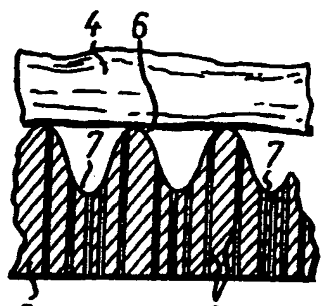

Fig 4.

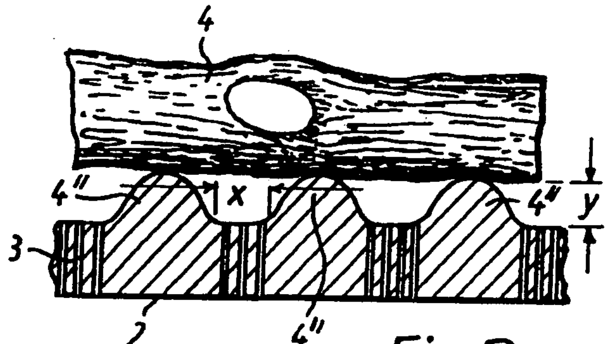

Fig 2.

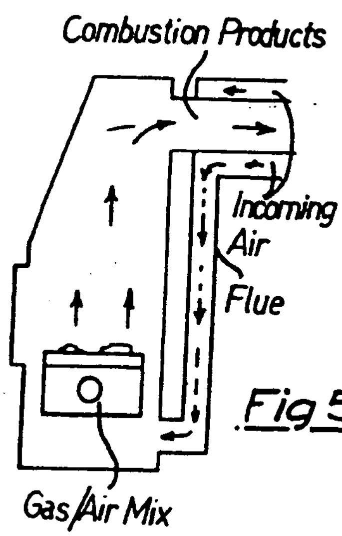

Fig 5.

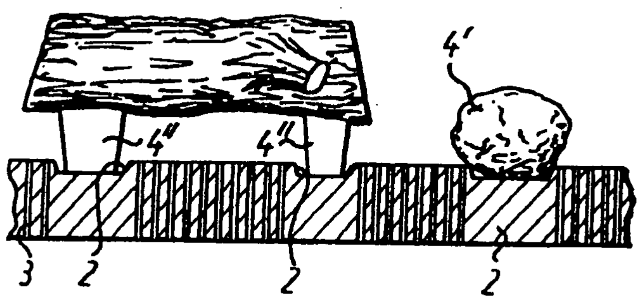

Fig 3.

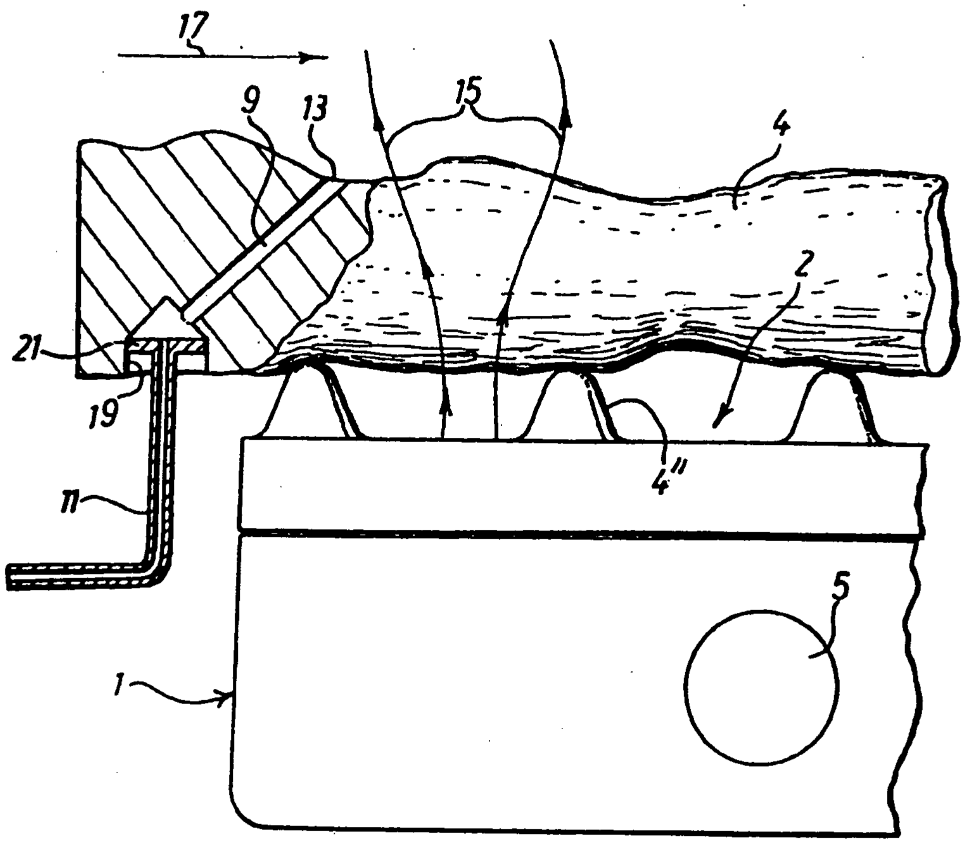

Fig 6

SPECIFICATION

Improvements relating to coal-effect gas fires

The present invention relates to coal-effect gas fires.

Coal-effect gas fires are known. One such known fire has a gas burner located beneath a grid upon which coal or log elements usually made of a ceramic, are either scattered loosely or fixed to provide a desired fuel arrangement. In use the gas flames heat the grid and pass therethrough to heat the coal and/or log elements. The grid coal and/or log elements glow red as they are heated to thus produce the effect of a coal or log fire, the fuel elements and grid serving as radiant elements to provide the required heat. However, such a coal effect fire lacks the wispy or soft flames which lick around the coal or logs in a real coal or log fire, and the appearance of a hot fuel bed, and thus such a coal effect fire lacks realism. Such wispy flames can be produced by suitable aeration of the gas prior to combustion.

For optimised combustion performance, the optimum aeration of the gas is selected and in one form of coal effect fire, wispy or soft flames are additionally produced by the burning of neat gas from gas jets randomly spaced between the fuel elements. However, these neat gas flames can produce soot, particularly when burning hydrocarbon fuel gases.

The aim of the present invention is to provide a coal-effect gas fire wherein high heating efficiency is attainable together with the best possible realism.

According to the present invention there is provided a coal and/or log effect gas fire comprising a gas burner formed by at least one member having a plurality of bores formed therein, which bores, in use, feed the gas/air mix, a plurality of coal and/or log elements being located above the surface of said member adjacent to the outlets of said gas/air mix feed bores.

The coal or log elements are mounted on supports which may be leg-like projections of said elements or projections from the burner surface. The elements are preferably spaced not less than 12mm and not more than 20mm above the burner surface. This preferred spacing allows for correct combustion, quietness and the required visual effect of a hot fuel bed. Smaller spacing can prevent complete combustion and cause the gas/air mix to burn noisily. A large spacing does not always provide for the required visual effect.

Further, the said supports for the coal or log elements are preferably spaced apart from each other by a distance not less than 7mm, this minimum distance being necessary to ensure complete combustion. Also, for continuous uniformity of flame, at least three gas/air mix feed bores must be provided in the minimum 7mm spacing.

As an alternative to the provision of coal or log element supports, the said at least one member of the aerated gas burner may have an undulating surface, the coal or log elements being supported between peaks and the troughs being deep enough as specified hereabove, to provide the required performance. Essentially though in this latter embodiment, the coal or log elements must not block off any gas/air mix feed bores.

In use the gas/air mixture burns adjacent the said surface of said member, and around said coal and/or log elements. The heat generated by the flames is partially absorbed by the coal and/or log elements which act as radiant heating elements, and is partially reflected back to heat the said member which also acts as a radiant heating element. There is thus a build up of temperature in the said member incorporating the gas/air mix feed bores, in the fuel above and on said member, and in the said coal and/or log elements, giving the effect of a hot fuel bed. The primary aeration of the gas/air mix requires to be between 50% and 70% when using British natural gas, to obtain the hot fuel bed and sufficient flame to give the appearance of burning fuel. Suitable primary aeration levels can be determined for other gases. This aeration level produces hot wispy flames around the coal and/or log elements thus enhancing the realism of the fire. The gas burnt is therefore used for heating purposes whilst still attaining the desired realism. Also, this build up of heat is quick, resulting in a fire which emits the desired heating effect in the best possible time from initial ignition.

To enhance the realism of the fire wispy flames may also be produced on the surface of the imitation logs or coals by burning neat gas which passes through passages in the logs or coals, fed from a gas supply line. The neat gas thus burns at the exit of the passage or passages where it meets the hot combustion products from the said member and the relatively cold air passing over the fire. The efect of these intermingling zones is such as to produce long wispy orange coloured flame with a minimum amount of neat gas. A further natural effect is achieved by the neat gas diffusing along the log surface and burning slowly therein, the affected log area glowing in a cinderable fashion. To avoid soot formation the passages must terminate in the upper half of the log surface.

The flame appearance obtained from burning neat or aerated gas lacks the colours obtained from real live fuel fires. To overcome this the fuel can be coated, impregnated, or made from a solid inorganic material which when subject to increased temperature will release sodium atoms and impart a yellow colour to the surroundings to give the appearance of a normal combustion flame. Alternatively the fuel elements can be impregnated or made of this inorganic material, or renewable inorganic material elements may be strategically located between the fuel elements. The inorganic solid shall consist of three types of material.

1. As much sodium oxide as is consistent with the material being solid at the operating temperature.
2. Other oxide material such as silica, alumina or calcia which are added to give a suitable thermal

3. Particles of metal which are added to displace the sodium oxide from the solid. These could be iron, zirconium, aluminium or any non-volatile metal which would displace sodium from its oxide. This component may be omitted if there is sufficient water in the surrounding atmosphere.

To avoid a thermite reaction the aluminium can be substituted with iron or zirconium.

The principle of the reaction is that sodium atoms may be displaced from inorganic solids if another atom is available to maintain electrical neutrality and the temperature is sufficient to facilitate both the solid state diffusion which must occur and the evaporation of the sodium atoms from the surface of the solid. Under certain circumstances the replacing atom could be hydrogen from atmospheric water. Alternatively, the replacing atoms could come from the metal particles incorporated.

The material may be made using any conventional fabrication technique such as sintering or melting using the usual raw materials found in ceramics such as sodium carbonate, sand, clay, alumina, felspar etc. The metal should be in powder or flake form and if the material is made by the melting method should be added when the molten material is cast into moulds.

In one embodiment of the present invention the said member incorporating the gas/air mix feed bores is a rectangular, plate-like ceramic member in which a plurality of said feed bores are provided, said bores being regularly spaced from one another. Alternatively said bores may be randomly spaced apart. These feed bores open onto a planar surface upon which coal and/or log elements, preferably made from ceramic fibre, are located. To enable gas/air mix to burn from all of the feed bores and thus produce the desired heat build up to optimum advantage, the planar surface may have upstanding projections integrally formed therewith, which act as supports upon which the coal and/or log elements rest or are secured. Alternatively each coal and/or log element may be provided with spikes which support said elements above the planar surface. The spacings of the supports, the planar surface, and the coal or log elements are within the limits previously discussed.

One or more of said members can form a wall of a plenum chamber into which gas/air mixture is fed. Said plenum chamber may also be provided with a baffle system to provide for a preferential gas/air mixture supply to certain regions to further enhance the realism of the outward appearance of the fire.

The present invention may equally well be applied to open front gas fires or balanced flue gas fires.

The present invention will now be further described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a partially cutaway perspective view of one embodiment of burner for use in the present invention.

Figure 2 is an enlarged cross-sectional view of part of the upper part of the burner of Figure 1,

Figure 3 is the same view as Figure 2, of a modified form of burner,

Figure 4 is the same view as Figure 2, of a further modified form of burner,

Figure 5 is a diagrammatic cross-sectional view of a balanced flue gas fire incorporating the burner of Figure 1, and

Figure 6 is an end view of a modified form of burner constructed according to the present invention.

The gas fire burner illustrated in Figures 1 and 2 of the accompanying drawings comprises a plenum chamber 1, the top wall of which is a rectangular plate-like member 2 made of ceramic material, through which a plurality of regularly spaced apart gas/air mix feed bores 3 extend. Alternatively the feed bores 3 can be randomly spaced apart. Each feed bore 3 is small in diameter as compared to its length so that any gas/air mix passing along the feed bores, burns in the region of the outlet ends of the bores or just thereabove. Located above the planar surface of member 2 are a plurality of simulated log elements 4, each being made of a ceramic, preferably ceramic fibre. Alternatively or in addition to the coal elements, ceramic coal elements 4' can be used.

The log elements 4 are supported on projections 4" which are integrally formed with member 2 and take the form of simultated coal elements.

These projections 4" are so designed as to provide a spacing 'y' between the log elements 4 and the surface of member 2, i.e. the gas outlets, of between 12mm and 20mm. If spacing 'y' is less than 12 mm then the gas can burn noisily and complete combustion does not necessarily take place. Also, the desired visual effect of a hot fuel bed is not always obtained. If spacing 'y' is greater than approximately 20mm, again the desired visual effect is not obtained as the desired temperature build-up is not readily evident. Further, for complete combustion to occur the projections 4" are spaced apart by a distance 'x' which should not be less than 7mm. Also, for continuous stable flames at least three gas/air mix feed bores 3 must open between any two projections 4".

In the alternative embodiments of the present invention shown in Figures 3 and 4 of the accompanying drawings the same reference numerals have been used as in Figures 1 and 2 for equivalent features.

In the embodiment of Figure 3, the simulated log elements 4 have support projections 4" integrally formed therewith, the projections 4" locating in recess 2' in the surface of planar member 2. These projections 4" maintain log elements 4 at the 'x' and 'y' spacings of Figures 1 and 2 thus providing the required hot fuel bed simulation. Additional simulated coal elements 4' can also be provided, these coal elements 4' being retained in recesses in the planar member 2 and merely adding to realism or acting as supports for log elements as per Figures 1 and 2. Again a minimum of three gas/air mix feed bores are provided between supports, this being necessary for stable flames.

In the embodiment of Figure 4, the member 2 has an undulating surface, the log elements 4 being

supported on the peaks 6 and the throughs 7 being deep enough to provide the desired 'x' and 'y' spacings of Figures 1 and 2 to thus ensure the hot fuel bed simulation. Care must be taken to prevent the log or coal elements from blocking any of the gas/air mix feed bores 3.

In use, gas/air mix is fed to the plenum chamber 1 via pipe 5, the gas/air mix passing along feed bores 3 and being ignited on the surface of plate-like member 2. The gas flames generate heat beneath the log elements 4, this heat energy being partially absorbed by the log elements 4 which act as radiant heat elements and which glow red as per a real fire, when heated to a sufficient extent, and being partially reflected towards the member 2. Thus member 2 is heated as well as log elements 4, and also acts as a radiant heating element. Due to this reflection there is a build up of heat in the region of member 2 and log elements 4 which simulate the appearance of a hot fuel bed with sufficient flame to simulate burning fuel. The primary aeration of the gas also requires to be between 50% and 70% when using British natural gas, this aeration being necessary to obtain the hot fuel bed and sufficient flame to give the appearance of burning fuel, and to produce hot wispy flames around the coal and/or log elements (4,4') to thus enhance the realism of the fire.

Wispy flames may also be produced on the surface of the imitation logs 4 (see Figure 6) by burning neat gas which passes through passage 9 in logs 4, the passage 9 being fed by a gas supply line 11. Any number of such passages 9 can of course be provided with their outlets 13 at random locations. The neat gas thus burns at the outlet 13 where it meets hot combustion products from said member 2 (see arrow 15) and the relatively cold air passing over the fire (see arrow 17). The effect of these intermingling zones is to produce long wispy orange coloured flames utilising a minimum of neat gas. A further natural effect is achieved by the neat gas diffusing along the log surface and burning slowly therein, the affected log area glowing in a cinder-like manner. Soot formation is avoided by the passages opening in the upper half of a log. Preferably the gas supply line 11 connects with an enlarged portion 19 of the passage 9, on the underside of the log 4 by means of a platform 21 having an angled dome (12°) from which neat gas can be channelled along a desired direction. For the best flame effect the passages 9 should be not less than 6 mm and not greater than 8 mm in transverse cross-sectional dimension.

The flame appearance obtained from burning aerated gas lacks the colours obtained from real live fuel fires. To overcome this the log and/or coal elements 4,4' are coated with a solid inorganic material which when subjected to increased temperature will release sodium atoms and impart a yellow colour to the surroundings to give the appearance of a normal combustion flame. Alternatively the fuel elements can be impregnated or made of this inorganic material, or members made of this inorganic material can be strategically placed between the fuel elements. In the latter case, for the best effect, the inorganic members are preferably located on the boundary between cool and hot gas regions. Thus the inorganic members can be easily replaced when necessary.

The inorganic solid shall consist of three types of material:-

(i) As much sodium oxide as is consistent with the material being solid at the operating temperature of the fire,

(ii) Other oxide material such as silica, alumina, or calcia which are added to give a suitable thermal stability.

(iii) Particles of metal which are added to displace the sodium oxide from the solid. These can be iron, zirconium, alumina or any non-volatile metal which would displace sodium from its oxide. This component may be omitted if there is sufficient water in the surrounding atmosphere.

To avoid a thermite reaction the aluminium can be replaced with iron or zirconium.

Typical compositions would be:-

(a)	40% Sodium Oxide	– Na_2O
	50% Silica	– SiO_2
	10% Calcium Oxide	– CaO

where water vapour from the surrounding atmosphere is the source of the displacing atom, i.e. hydrogen.

(b)	33% Sodium Oxide	– Na_2O
	42% Silica	– SiO_2
	8% Calcium Oxide	– CaO
	17% Aluminium Powder	

where aluminium atoms displace sodium.

To avoid a thermite reaction, the aluminium could be replaced by other powdered metals e.g. zirconium, iron.

By adjustment of the refractory oxide, materials more suitable for higher temperature applications may be obtained.

Typically,

(i)	40% Sodium Oxide	– Na_2O
	50% Silica	– SiO_2
	10% Zirconium Oxide	– ZRO_2

where water vapour from the surrounding atmosphere is the source of the displacing atom i.e. hydrogen.

(ii)	30% Sodium Oxide	– Na_2O
	37% Silica	– SiO_2
	8% Zirconium Oxide	– ZrO_2
	25% Zirconium Metal Powder	

where Zirconium atoms displace sodium.

The principle of the reaction is that sodium atoms may be displaced from inorganic solids if another atom is available to maintain electrical neutrality and the temperature is sufficient to facilitate both the solid state diffusion which must occur and the evaporation of the sodium atoms from the surface of the solid. Under certain circumstances the replacing atom can be hydrogen from atmospheric water. Alternatively the replacing atoms can come from the metal particles incorporated.

The material can be made using any conventional fabrication technique such as sintering or melting using the usual raw materials found in ceramics such as sodium carbonate, sand, clay, alumina, felspar etc. ... The metal should be in powder or flake form and if the material is made by the melting method, should be added when the molten material is cast into moulds.

The gas fire burners described hereabove can be used in open gas fires or in balanced flue gas fires schematically shown in Figure 5.

The present invention thus provided a coal/log effect gas fire with a simulated hot fuel bed and realistic wispy flames which can be further enhanced by incorporating a simulated fuel element of approximate composition.

CLAIMS

1. A coal and/or log effect gas fire comprising a gas burner formed by at least one member having a plurality of bores formed therein, which bores, in use, feed a gas/air mix, a plurality of coal and/or log elements being located above the surface of said member adjacent to the outlets of said gas/air mix feed bores.

2. A gas fire as claimed in claim 1, in which the coal and/or log elements are made of a ceramic.

3. A gas fire as claimed in claim 2, in which the coal and/or log elements are made of ceramic fibre.

4. A gas fire as claimed in any one of claims 1 to 3, in which the coal and/or log elements are mounted above the surface of said member by means of supports.

5. A gas fire as claimed in claim 4, in which said supports are formed by leg like projections of said elements.

6. A gas fire as claimed in claim 4, in which said supports are formed by projections from said surface of said member.

7. A gas fire as claimed in any one of the preceding claims, in which the elements are spaced not less than 12mm and not more than 20mm above the surface of said burner member.

8. A gas fire as claimed in any one of claims 4, 5 and 6, in which said supports are spaced apart from each other by a distance not less than 7mm.

9. A gas fire as claimed in claim 4, in which said supports are formed by said burner member having an undulating surface, the coal and/or log elements being supported between peaks so as to not block off any gas/air mix feed bores.

10. A gas fire as claimed in any one of the preceding claims, in which the primary aeration of the gas/air mix is between 50% and 70%.

11. A gas fire as claimed in any one of the preceding claims, in which the coal and/or log elements are coated or impregnated with a material which when subjected to increased temperature releases atoms which colour the flame to give the appearance of a normal combustion flame.

12. A gas fire as claimed in claim 11, in which said material is a solid inorganic material which releases sodium atoms to impart a yellow colour to the flame.

13. A gas fire as claimed in claim 1, in which the fuel elements are made of a solid inorganic material which, when heated, gives off sodium atoms to impart a yellow colour to the flame.

14. A gas fire as claimed in any one of claims 11 or 12, or claim 13, in which the fuel elements are coated, impregnated or made of a material comprising sodium oxide, other oxide material for thermal stability, and particles of metal.

15. A gas fire as claimed in any one of the preceding claims, in which said member is a rectangular,

plate-like ceramic member in which a plurality of gas/air mix feed bores are provided, said member forming at least part of a wall plenum chamber.

16. A gas fire as claimed in claim 15, in which the bores are randomly spaced apart.

17. A gas fire as claimed in claim 15 or 16, in which said plenum chamber is provided with one or more buffles.

18. A gas fire as claimed in any one of the preceding claims, in which a passage for use in feeding neat gas extends through a coal or log element, said passage being connected to a gas supply line.

19. A gas fire as claimed in claim 18, in which said passage has an outlet in the upper half of the element.

20. A coal and/or log effect gas fire, constructed substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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